

The opinion in support of the decision being entered today was *not* written for publication and is *not* binding precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

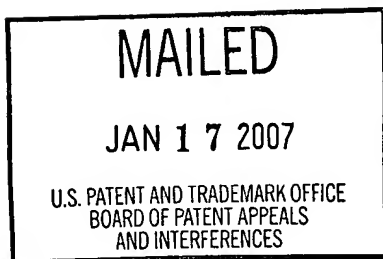
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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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*Ex parte* ROBERT LAWS and STEPHEN PATRICK MORICE

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Appeal 2006-2442  
Application 10/070,228  
Technology Center 3600

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Decided: January 17, 2007

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Before ANITA PELLMAN GROSS, JENNIFER D. BAHR, and LINDA E.  
HORNER, *Administrative Patent Judges*.  
HORNER, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal under 35 USC § 134(a) from the Examiner's final rejection of claims 1-10 and 19-29. Claims 11-18 have been withdrawn as directed to a non-elected invention. Claim 30 has been objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

We AFFIRM IN PART.

## BACKGROUND

The Appellants' invention relates to a method of seismic surveying in which seismic energy is emitted at different depths during a survey (Specification 1). Claims 1 and 19, reproduced below, are representative of the subject matter on appeal. A copy of all of the claims can be found in the appendix to the Appellants' Brief.

1. A method of seismic surveying using one or more marine vibrators, the method comprising emitting seismic energy at two or more different depths during a sweep.
19. A method of seismic surveying as claimed in claim 1, comprising varying the depth of a marine vibrator while the marine vibrator is emitting seismic energy.

The Examiner relies upon the following as evidence of unpatentability:

Manin	US 4,136,754	Jan. 30, 1979
Ray	US 4,493,061	Jan. 08, 1985
Lugg	GB 2 148 503 A	May 30, 1985
Haughland	US 4,721,180	Jan. 26, 1988
Huizer	US 4,727,956	Mar. 01, 1988
Sallas	US 4,918,668	Apr. 17, 1990
Barber	US 5,469,404	Nov. 21, 1995
Yang	US 5,535,176	Jul. 09, 1996

Bouyoucos  
Barr

WO 97/06452  
US 5,724,306

Feb. 20, 1997  
Mar. 03, 1998

The following rejections are before us for review.

1. Claims 1-8 stand rejected under 35 USC § 103(a) as being unpatentable over any one of Bouyoucos, Barber, or Yang in view of Sallas and Barr.
2. Claims 1 and 6-8 stand rejected under 35 USC § 103(a) as being unpatentable over Ray or Manin in view of Sallas and Barr.
3. Claims 1 and 6 stand rejected under 35 USC § 103(a) as being unpatentable over Huizer in view of Sallas and Barr.
4. Claims 1-10 stand rejected under 35 USC § 103(a) as being unpatentable over Lugg in view of Sallas and Barr.
5. Claims 1-8 and 19-29 stand rejected under 35 USC § 103(a) as being unpatentable over Haughland in view of Sallas and Barr.

Rather than reiterate in detail the conflicting viewpoints advanced by the Examiner and the Appellants regarding this appeal, we make reference to the Examiner's Answer (mailed April 4, 2006) for the Examiner's complete reasoning in support of the rejections and to the Appellants' Brief (filed September 21, 2005) for the Appellants' arguments.<sup>1</sup>

### OPINION

In reaching our decision in this appeal, we have carefully considered the Appellants' specification and claims, the applied prior art, and the respective

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<sup>1</sup> The Appellants did not file a Reply Brief.

positions articulated by the Appellants and the Examiner. As a consequence of our review, we make the determinations that follow.

In each of the rejections, the Examiner combined references, which disclose deploying marine seismic sources at different depths, with the teachings of Barr and Sallas, which teach that marine vibrators (sweep sources) and air guns (impulse sources) are commonly-used types of energy sources in seismic surveying (Answer 5). The Examiner determined that the difference between the claims and Bouyoucos, Barber, Yang, Ray, Manin, Huizer, Lugg, and Haughland lies in the type of marine seismic sources used (Answer 5). The Examiner determined that Sallas teaches that although air guns are popular as seismic energy sources, environmentalists prefer marine vibrators over air guns because air guns are harmful to marine life (Answer 5). The Examiner found that it would have been obvious to one having ordinary skill in the art to have substituted a marine vibrator for the air guns of Bouyoucos, Barber, Yang, Ray, Manin, Huizer, Lugg, and Haughland in view of the well known of use of air guns and marine vibrators as seismic energy sources in the marine environment, and the preference for marine vibrators over air guns (Answer 5-6).

The Appellants contend that Bouyoucos, Barber, Yang, Manin, and Huizer all relate to techniques used to shape seismic signals generated by impulse sources, and that they do not teach mitigating notch frequencies or surface reflections from sweep sources (Brief 5-6 and 10-13). We agree with the Appellants that the Examiner has not made a prima facie case of obviousness in view of the teachings of these references combined with Barr and Sallas. We see no motivation to

substitute marine vibrators for the air guns of Bouyoucos, Barber, Yang, and Huizer absent hindsight, because the signals produced from air guns are different from the signals produced from marine vibrators, and these references all relate to the specifics of shaping the signals from impulse sources. As such, there would have been no motivation to substitute marine vibrators in these references because the signals emanating from marine vibrators are different from impulse sources, and thus the teachings of these references as to signal shaping of impulse source signals would not have been applicable to marine vibrators. Accordingly, we do not sustain the Examiner's rejection of claims 1-8 under 35 USC § 103(a) as unpatentable over the combined teachings of Bouyoucos, Barber, or Yang with Barr and Sallas, and we do not sustain the Examiner's rejection of claims 1 and 6 under 35 USC § 103(a) as unpatentable over the combined teachings of Huizer, Barr and Sallas. Manin suffers from the same deficiency as Bouyoucos, Barber, Yang, and Huizer; however, see *infra* for the treatment of that rejection.

The Appellants' argument as to signal shaping, however, does not apply to the teachings of Ray, Lugg, and Haughland, all of which the Appellants admit specifically teach mitigation of interference from ghost reflections (Brief 12-14). In particular, Ray teaches that pulsing from a gas expansible energy source, such as an air gun, can produce a wave in an upward direction which returns as a reflected or ghost pulse and creates notches in the frequency domain (Ray, col. 1, l. 61 – col. 2, l. 11). Ray teaches that by stacking the energy sources with certain vertical and horizontal spacing, positive portions of the waves accumulate while the negative portions (ghost pulses) do not (Ray, col. 3, ll. 3-16 and col. 4, ll. 8-13).

Similarly, Lugg teaches that implosive energy sources, such as water guns, suffer from the same ghost signal problem due to waves reflected from the air-sea interface (Lugg, p. 1, ll. 24-34). Lugg teaches a method to avoid the ghost signal problem in which a first source is fired, and then a second source at a depth different from the first source is fired at a second time different from the first, so that reflections of the wave fields from the first and second sources from the air-sea interface above the source will partially cancel each other (Lugg, p. 1, ll. 49-64).

Haughland teaches generally that impulsive sources for seismic energy generate unwanted pulses commonly called “ghost” pulses (Haughland, col. 1, ll. 20-26). Haughland notes that even when using an array of sources, the frequency spectrum retains a strong ghost notch (Haughland, col. 1, ll. 60-63). Haughland teaches that it was known in the art to mitigate the presence of a source ghost by configuring the sources to suppress the generation of the ghost pulse (Haughland, col. 2, ll. 43-45). In particular, Haughland cited to prior art systems that located a variety of sources at different depths, including explosive sources, air guns, and implosive sources (Haughland, col. 2, ll. 46-65). Haughland’s specific invention involved deploying a source array having a plurality of source elements at each of a plurality of depths in which the source elements are all suspended from a single float (Haughland, col. 2, l. 66 – col. 3, l. 1).

For these three references, the Appellants argue that there is no motivation to combine the references with the teachings of Barr and Sallas because “approaches mitigating the effects of notch frequencies in impulse sources are generally

inapplicable to sweep sources” (Brief 12-14) (citing specification, p. 4, ll. 18-25). The portion of the specification referred to by the Appellants in support of this argument, however, teaches only that one particular prior art solution to attenuation at low frequencies for air gun sources – i.e., using seismic energy sources having greater amplitude at low frequencies – is difficult to employ with marine vibrators, because the mechanical constraints of marine vibrators make it difficult to increase the amplitude at low frequencies. This portion of the specification does not support a finding that *all* approaches used to mitigate the effects of notch frequencies in impulse sources are inapplicable to sweep sources. We see no reason why one having ordinary skill in the art, possessed with the teachings of Ray, Lugg, and Haughland of using seismic energy sources at different depths to mitigate ghost reflection interference, would not have been motivated to apply this approach in the context of marine vibrators to solve the same problem. We find that Barr, as discussed *infra*, teaches that marine vibrators suffer from the same problem of interference from signals reflected from the surface of the water.

With regard to Barr and Sallas, the Appellants contend that although the references teach the use of sweep sources, neither teaches anything about mitigating the effects of notch frequencies (Brief 9). While neither may specifically refer to notch frequencies, Barr recognizes the problems associated with noise from waves reflected from the surface of the water. Specifically, we find that Barr teaches that air guns and marine vibrators are energy sources commonly used in marine seismic surveying (Barr, col. 1, ll. 39-40). Barr further notes that both air guns and marine vibrators produce seismic waves of pressure

differentials which propagate through the water and into the subterranean formations below (Barr, col. 1, ll. 45-48). Barr further recognizes that a problem exists when using these energy sources of noise from upward-traveling reflected waves that reach the surface of the body of water and then are reflected back downward (Barr, col. 4, ll. 47-62). This noise is similar to the ghost signals described in the present invention, in that in both cases, the noise is created from waves from the seismic energy source that are reflected off the surface of the water back down to the hydrophone receivers.

To establish a prima facie case of obviousness, the references being combined do not need to explicitly suggest combining their teachings. See e.g., *In re Kahn*, 441 F.3d 977, 987-88, 78 USPQ2d 1329, 1337-38 (Fed. Cir. 2006) (“the teaching, motivation, or suggestion may be implicit from the prior art as a whole, rather than expressly stated in the references”); and *In re Nilssen*, 851 F.2d 1401, 1403, 7 USPQ2d 1500, 1502 (Fed. Cir. 1988) (“for the purpose of combining references, those references need not explicitly suggest combining teachings.”).

An explicit teaching that identifies and selects elements from different sources and states that they should be combined in the same way as in the invention at issue, is rarely found in the prior art. As precedent illustrates, many factors are relevant to the motivation-to-combine aspect of the obviousness inquiry, such as the field of the specific invention, the subject matter of the references, the extent to which they are in the same or related fields of technology, the nature of the advance made by the applicant, and the maturity and congestion of the field.

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Precedent has also recognized that “[t]he suggestion or



motivation to combine references does not have to be stated expressly; rather it may be shown by reference to the prior art itself, to the nature of the problem solved by the claimed invention, or to the knowledge of one of ordinary skill in the art.”

*In re Johnston*, 435 F.3d 1381, 1385, 77 USPQ2d 1788, 1790-91 (Fed. Cir. 2006) (citing *Medical Instrumentation and Diagnostics Corp. v. Elekta AB*, 344 F.3d 1205, 1221-22 (Fed. Cir. 2003)). “The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art.” *Kahn*, 441 F.3d at 987-88, 78 USPQ2d at 1336 (quoting *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000)).

As discussed *supra*, the nature of the problem to be solved in Ray, Lugg, and Haughland is the problem of interference with the direct signal from a seismic source due to ghost signals reflected from the surface of the water. Similarly, in Barr, the nature of the problem to be solved is to mitigate the interference from signals reflected from the surface of the water. Barr teaches that this interference occurs in signals from air guns and marine vibrators. As such, implicit motivation to combine the teachings of Ray, Lugg, or Haughland with the teaching of Barr exists due to the nature of the problem to be solved by these references. We find that one having ordinary skill in the art at the time of the invention would have been motivated to apply the solutions of Ray, Lugg, or Haughland – to emit seismic signals from different depths – to the case of marine vibrators, because Barr recognizes that marine vibrators, like air guns, also suffer from interference due to reflected signals.

As such, we find sufficient motivation to combine the teachings of Ray, Lugg, or Haughland with Barr that would have led one having ordinary skill in the art to the present invention. Accordingly, we sustain the Examiner's rejections under 35 USC § 103(a) of claims 1 and 6-8 as unpatentable over the combined teachings of Ray or Manin<sup>2</sup> with Barr and Sallas, claims 1-10 as unpatentable over the combined teachings of Lugg, Barr, and Sallas, and claim 1-8 as unpatentable over the combined teachings of Haughland, Barr, and Sallas.<sup>3</sup>

The Appellants separately argue the patentability of claims 19-29, which recite the step of varying the depth of a marine vibrator while the marine vibrator is emitting seismic energy. In particular, the Appellants argue that Haughland does not mention varying the depth of an air gun while it fires and that this would be highly impracticable – if not impossible – to implement in practice (Brief 15). We agree that Haughland does not teach or suggest varying the depth of the air gun while it fires. The excerpt from Haughland relied on by the Examiner merely teaches firing the air guns at different fixed depths at different times (Haughland, col. 5, l. 54 – col. 6, l. 12). As such, we find no teaching, suggestion, or motivation from the combined teachings of Haughland, Barr, and Sallas that would have led to the invention of claims 19-29. Accordingly, we do not sustain the Examiner's

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<sup>2</sup> The Examiner appears to rely on Ray and Manin for the same teaching. Because we find sufficient teaching in the disclosure of Ray, when combined with Barr, we do not find it necessary to rely on Manin for our finding of unpatentability.

<sup>3</sup> The Examiner appears to rely on Barr and Sallas for the same teaching. We find Sallas to be merely cumulative of Barr.

rejection of claims 19-29 under 35 USC § 103(a) as unpatentable over the combined teachings of Haughland, Barr and Sallas.

### CONCLUSION



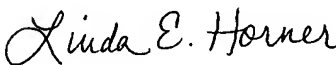
To summarize:

1. The decision of the Examiner to reject claims 1-8 under 35 USC § 103(a) as being unpatentable over Bouyoucos, Barber, or Yang in combination with Sallas and Barr is not sustained.
2. The decision of the Examiner to reject claims 1 and 6-8 under 35 USC § 103(a) as being unpatentable over Ray or Manin in combination with Sallas and Barr is sustained.
3. The decision of the Examiner to reject claims 1 and 6 under 35 USC § 103(a) as being unpatentable over Huizer, Sallas, and Barr is not sustained.
4. The decision of the Examiner to reject claims 1-10 under 35 USC § 103(a) as being unpatentable over Lugg, Sallas, and Barr is sustained.
5. The decision of the Examiner to reject claims 1-8 under 35 USC § 103(a) as being unpatentable over Haughland, Sallas, and Barr is sustained.
6. The decision of the Examiner to reject claims 19-29 under 35 USC § 103(a) as being unpatentable over Haughland, Sallas, and Barr is not sustained.

Appeal 2006-2442  
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No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a). *See* 37 CFR § 1.136(a)(1)(iv).

AFFIRMED IN PART

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ANITA PELLMAN GROSS	)	
Administrative Patent Judge	)	
	)	
	)	
	)	BOARD OF PATENT
JENNIFER D. BAHR	)	APPEALS
Administrative Patent Judge	)	AND
	)	INTERFERENCES
	)	
	)	
LINDA E. HORNER	)	
Administrative Patent Judge	)	

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